The Synchronisation of Clocks.

Attention was directed in the public Press by Sir John Cockburn to the divergence in time shown by the publicly exposed clocks in London and other large centres, also the inconvenience thus caused to the public. A suggestion was received by the executive committee that a subcommittee should be appointed to deal with the subject.

After careful consideration of evidence brought before it, the committee drew up the report printed in NATURE of August 13, 1908. This report was sent to the Lord Mayor, the London County Council, the General Post Office, His Majesty's Office of Works, the Local Government Board, the British Horological Institute, and the various railway companies. Most of the bodies referred to merely acknowledged receipt of the communication, or else expressed disinclination to act owing to administrative difficulties or to the expense of synchronisation. The reply received from the Public Health Department, Guildhall, City of London, is of special interest, as it states "that the Corporation on March 26, 1903, made it a condition of future consent to the erection of clocks over public ways in the City that they should be synchronised with Greenwich time."

Naming of Streets.

The executive council has considered the matter of naming new streets, and the re-naming of streets, the names of which it is intended to alter, after distinguished men of science, now deceased. The members of the executive committee were requested to send in names which they considered it would be desirable to employ in this way. A list containing a large number of names was thus drawn up, and was presented to the executive committee, who, after careful consideration, reduced it to the following thirty-one names:—Newton, Darwin, Harvey, Jenner, Huxley, James Watt, Gilbert, Kelvin, Faraday, Joule, Clerk Maxwell, Stokes, Tyndall, Captain Cook, Livingstone, Franklin, Ross, Bruce, Mungo Park, Cavendish, Dalton, Priestley, Boyle, Andrews, Halley, Herschel, Horrocks, Adams, Bradley, Howard, Piddington. This list was then sent to the County Council with the following letter:—

"I am directed by the president, Mr. Haldane, to ask you to be so good as to bring before the L.C.C. the striking difference which exists between the street nomenclature in London and Paris. In the latter City there is no illustrious French man of science whose name is not connected with some street or square. It is hardly too much to say that in London there is no case of which the same can be said."

"This matter has been inquired into by the executive committee of the British Science Guild, and I am directed to forward to you the accompanying list of thirty-one names, which they have carefully considered, and think could be properly used in this connection should the opportunity arise in the naming of new thoroughfares or the change of name of old ones."

"They are well aware that the present condition of things has arisen in the past because there has been no such body as the London County Council interested in the nation's history and intellectual development; in its absence, the builder and the owner of the land during the last 300 years have been the chief people interested."

New Patents and Designs Bill.

Two years ago the Guild appointed a committee to consider the question of the amendment of Patent Laws. Sir John Cockburn was also appointed to confer with the authorities of the Associated Chambers of Commerce, and to take part in a deputation to the President of the Board of Trade. It is with pleasure that the Guild is able to direct attention to the beneficial effect of the new Patent Act of 1907, the results of which are now beginning to be apparent.

So far back as 1884, in his presidential address to the Society of Chemical Industry, the late Sir William Perkin said that one of the causes of the loss of the coal-tar colour industry to this country was the condition of our patent laws. For more than twenty years Mr. Levinstein and others have been working to convince the Governments of the need of reform in this direction.

The consequences of the Act now in force are that, not only are many wealthy foreign firms building new factories in this country, but that licences to work foreign patents are being obtained by many purely British firms which, before the passing of this Act, they were unable to secure. Messrs. Meister Lucius and Brunning, of Höchstam Main, in Germany, have erected a factory at Port Ellesmere, on the Mersey, and are now employing a large staff of workmen in the preparation of anilin dyes, synthetic indigo, and fine chemicals. The Badische Anilin- und Soda-Fabrik are also erecting large works on the Manchester Ship Canal. The Gillette Razor Company, of America, have works at Leicester. The German Pottery Co., of Alfred Johnson and Co., are starting works in Kent, and many other firms from abroad are setting up works at Liverpool, Manchester, Warrington, Enfield, Tottenham, and other localities. Altogether about twenty new works have been erected by foreign patentees owing to the passing of this new Act, and independent of these a large number of licences have been granted to British firms.

Formation of Sections in Australia and Canada.

A committee has been formed in Sydney, New South Wales, with the Hon. Sir H. Normand MacLaurin, Chancellor of Sydney University, as chairman, and Dr. Walter Spencer as secretary. A number of members have joined the New South Wales branch of the British Science Guild. In Montreal a strong committee has been brought together, with Mr. George E. Drummond as president and Prof. H. T. Barnes as secretary. It is intended to hold a meeting at the end of the winter, either in Montreal or Toronto, to inaugurate the Canadian branch of the Guild. The formation of branches of the Guild in the colonies will add strength to the parent society, and cannot fail to foster goodwill between the colonies and the Mother Country, thus helping to strengthen the fabric of the Empire.

Presentation of Illuminated Address to President Fallières.

The opportunity of the visit of the President of the French Republic to England to inspect the Franco-British Exhibition was taken advantage of to present him with an illuminated address. The movement was originated by Sir Norman Lockyer, and after consultation with the Royal Society and the Royal Academy, the Guild was asked to undertake the work. The address was presented on May 27, 1908, at St. James's Palace, and was received by M. Fallières in a most cordial manner.

SYSTEM AND SCIENCE IN EDUCATION.

Primary and Secondary Education.

AFTER taking into consideration the memorandum prepared by the chairman of the executive committee, the education committee has adopted the following resolutions which embody and extend those already submitted to the executive committee:—

(1) No local authority or other body should be empowered to grant total exemption from attendance at school to children under fourteen years of age.

(2) Provision should be made for compulsory attendance at day or evening (preferably day) continuation schools for young persons above the age of fourteen years, who are not attending craft or secondary schools, for two to four hours a week during two years of forty weeks in each year. Pupils attending evening continuation schools between these ages should not be permitted to commence work before 8 a.m. on those days on which they attend the schools. The number of hours during which pupils attend part-time day or evening continuation schools should be counted as "hours of employment" for the purpose of the Acts dealing with the employment of young persons.

(3) There should be established in all educational areas a sufficient number of craft schools with a two-years' course for boys and girls between the ages of about fourteen and sixteen years. Due regard should be paid in these schools to the continuance of the general education of the pupils, but special provision should be made for sound scientific and technical training in relation to the industries or requirements of the district. The aim of these schools should be to provide preparatory training in

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[1] Reports of two committees of the British Science Guild presented at t annual general meeting on January 22.

handicraft for pupils who propose afterwards to follow industrial or commercial careers or to manage households intelligently. The fees should be low, and there should be scholarships giving free tuition, travelling, and maintenance allowances, graduated according to the ages of the scholars. These schools might also provide for the continuation classes referred to in clause 2.

(4) Local education authorities should be urged to establish or aid in establishing an adequate supply of secondary schools of a high educational type. These schools should have highly qualified staffs adequately paid, and should be administered by a board of governors or managers. No effort should be spared to make these schools thoroughly efficient, and to this end the curriculum followed should admit of some amount of variation. Where the majority of pupils remain to eighteen years of age a higher standard on the purely academic side could be aimed at than in the case of schools where the bulk of the pupils leave at sixteen years of age or thereabouts. To secure that the best minds in the primary school shall pass into the secondary school, there should be a sufficient number of free places and maintenance scholarships to render secondary education accessible to boys and girls capable of benefiting by it who propose to remain at school until the completion of at least a four-years' course from the date of entry.

(5) A primary school certificate should be introduced which would serve as a passport to the craft school and the secondary school. School certificates should also be granted to pupils who work satisfactorily through the courses at the craft school or at the secondary school. The certificates should be based not upon examinations, but chiefly upon reports by the teachers as to the ability of the pupils to profit by higher courses of instruction.

(6) The matriculation examination of any British university, and the secondary school leaving certificate, certain requirements being satisfied, should qualify for entrance to any British university or technical college, and to the various professional courses, without further examination and in lieu of the present preliminary examinations.

(7) School records and the reports of teachers should at every stage supersede largely the present system of estimating ability by examinations. The award of scholarships should be based largely upon the reports of the teachers of the schools which the pupils are attending at the time of their promotion. School-leaving certificates should be awarded only to pupils in schools certified as efficient for that purpose by a responsible inspecting authority, and a list of these schools should be published. Schools in which this privilege was abused should be removed from the list. By placing upon the teachers the responsibility for nominating pupils for certificates or scholarships, the credit of the school would soon secure that only the most capable or promising pupils would have their passage facilitated to places of higher learning. In all examinations the teacher should be associated with the external examiner.

(8) In every public or private primary or secondary school, the instruction in all branches of the curriculum should be so given as to accustom the pupil to careful observation and experiment, whatever may be the specific nature of the subject that is being studied; and to this end not only should there be a proper amount of labortory and workshop practice, but the scientific spirit of the laboratory and workshop should so far as possible be employed in the ordinary class-room. In this way the school would provide the best kind of preliminary training for industrial life, and would also ensure that those who subsequently receive a university education shall bring to the work which will devolve upon them in various fields of activity, including the administration of public departments, an adequate training in scientific method.

(9) An arrangement should be arrived at whereby a satisfactory report as to educational efficiency, made by a responsible inspecting authority would in ordinary cases render similar inspection during the same school year unnecessary.

(10) Local authorities, governing bodies, and parents should realise that the salaries at present paid are in most cases quite inadequate to secure a supply of highly-qualified and capable teachers. The opportunities for advancement offered by other careers attract from the teaching profession many men, who by attainment and aptitude would promote the educational welfare of the nation. The conditions of service, salaries, and outlook of assistant teachers, whether engaged in the work of primary, secondary, or technical education, are in general most unsatisfactory, and unless they are improved they must fail to attract or retain the services of many men and women best qualified for the profession of teaching. A high standard in education can only be attained by generous provision for those who do the work, both in their active and declining years. Until this is recognised, it is futile to anticipate progress in procedure or success in any organic educational system, or to obtain from the present efforts and expenditure on education a sufficient return.

The Cost of teaching Practical Science in Schools.

An opinion expressed by the headmaster of Eton at a general meeting of the British Science Guild in 1907, to the effect that an extension of the teaching of science in public schools is checked by the heavy expenses attaching to practical work, has been under the consideration of a subcommittee of the Guild, and its members beg to make a brief statement of their convictions with regard to such practical teaching of science and the question of its extension.

The procedure adopted in teaching science should always differ considerably from that employed in teaching literary and linguistic subjects, and ordinarily does so differ. The main reason for this distinction lies in the fact that all exact physical knowledge must admit of objective realisation, that is, its demonstration in material objects under natural conditions must be possible; while the acquisition of any part of this knowledge already recorded, not to mention possible additions to the stock, necessarily involves extensive experience of a concrete character. The equipment for this purpose, still considered in some quarters as more or less separable from the course of instruction, involves expense, but that expense may be regarded, not so much as a defect at once tangible and flagrant in a branch of education still under suspicion, but rather as the life-blood of an activity inherent in modern civilisation. Whether a given society ignores it or turns it to its own use, the movement continues—in Lebensfluthen, in Thatensturm.

Expense is a relative term. All those who have been engaged in teaching science for the last twenty years are aware of a revolution during that period in the character of the apparatus employed for instruction in schools. A remarkable change has taken place in the direction both of cheapness and of simplicity. These results have been gained by organised efforts on the part of science masters by meeting in conference or by publication. It is widely recognised among these masters that simplicity and plainness in apparatus is a positive gain, and that the educational value of the instruction even increases with the bareness of the material by which it is supplied. As experience in this work has widened, it has become more and more apparent that scientific method rather than technical knowledge should be the aim of school teaching, and that in the earlier stages at all events preference should always be given to the study of the course of events which are normal and familiar rather than of such as are exceptional or specialised. There has been, in other words, an increasing tendency to assimilate the scope of elementary scientific study to the ordinary experience of civil and industrial life and the material of experiment to the range of every-day requirements. It is now generally admitted that the over-elaboration of apparatus inhibits enterprise and invention in the young pupil just as a costly mechanical toy stunts the imagination of the child, while it tends also to separate the exercises of the laboratory too abruptly from the events of the daily round. It is maintained that workshop practice may with advantage supplement the work of the laboratory and give it a broader practical basis: that the surviving though weakened boundary-wall between them might be broken down, with gain to both in the matter of increased economy as well as of added wealth of interest.

Such an outlet for the practical exercise of inductive reasoning is an urgent need in a scheme of education which is still very largely a matter of deductive exposition. A large stock of the experience only to be gained from an intimate acquaintance with the qualities and limitations of matter is a necessary disciplinary corrective of all abstract thinking, whether scientific or not, and we should beware how we repress it lest we destroy that practical-mindedness which we treasure as one of the most valuable of our national assets. Imbued as we are with these convictions, it is discouraging to meet with opinions which appear to have been formed at a period when they were in some measure justified by the direct transference to the school of the practice of the university without the necessary adaptation to a lower intellectual plane, and by other inevitable errors of the early and empirical stage of science teaching. It is some relief, however, that the charge which has to be met is a matter of pounds, shillings and pence, and not one of squandering educational opportunity or of wasting human effort.

Economy bears upon science teaching precisely at it bears upon every branch of education and every department of social administration, nor do its principles perforce wither away in the atmosphere of science. As practical experience extends, as the supply of trained teachers improves, as examinations become more scientific and less restricted in style, so will the spirit of investigation and research be stimulated, and sound standards of thought be established. Indeed, the question of outlay will almost cease to be relevant as the relation of output to expenditure improves, but if definite statements be called for, a wide range of inquiry has furnished them. From the information thus gained, it appears that the present average expenditure on apparatus and material is about 1*l.* per annum for each pupil receiving practical instruction in science in the public schools, and about 10*s.* per annum for each pupil in other secondary schools. It may be safely accepted as a maximum estimate—a fairly generous one—that physical and chemical laboratories can be equipped, maintained in apparatus, and supplied with consumable material, and provision also be made for the practical study of animate nature, on a basis of 100 boys working for 10 hours a week (or 40,000 boy-hours per annum), by an average annual expenditure of 150*l.* for a period of ten years. After this period of installation and accumulation of plant, the annual cost of maintenance and renewal need not exceed 100*l.* In other words, the cost per head should never exceed 30*s.* a year during the early constructive stage, and may be expected to fall much below that value after a period varying with the scope of the work, the degree of specialisation, and the number of students. But it is imperative that expenditure should be guided by experience, for a wrong start by a tyro may hamper himself or his successor for years. For this reason there is much valuable work to be done by any independent body which would undertake to serve as a standing committee for the sifting and coordination of results in these matters, and for advising and guiding those in need.

Save for a few of the chief public schools, the statements here made in connection with secondary education are fortunately to a great extent unnecessary. There are now about 750 secondary schools in England and Wales inspected by the Board of Education and receiving grants for efficient teaching. In these schools there are about 100,000 pupils taking a course which has been approved by the Board, and this course must provide instruction in science. The Board insists that "the instruction in science must include practical work by the pupils." In each of these secondary schools, and they include most of the grammar schools and endowed schools of the country, one or more laboratories must be provided. They are to be fitted with benches for their special purpose, and supplied with water, gas, and, when possible, electric current. Sufficient apparatus must also be provided for a reasonable course of work.

The governing bodies of all these schools must provide laboratories and apparatus for individual practical work whether they like it or no. The schools are not regarded as efficient or entitled to receive grants in aid of education, unless they comply with the regulations laid down by the Board for individual practical work in science. Provision for this purpose cannot be evaded by any secondary school which receives grants in aid, nor, on the other hand, would any reduction in its cost permit the teaching to be extended beyond the limits already imposed by the rightful claims of other subjects. Secondary schools which are less local in character and not qualified to receive grants, but are subject to considerable competition among themselves, are prompted by motives of self-preservation to give a prominent position in their curricula to scientific training. It is now only a few public schools which remain in an exceptional position and offer but limited opportunities of learning science to a portion of their pupils. If an extension of science teaching in such schools be desired, the cost of its provision does not appear to be the real obstacle.

THE WORLD OF LIFE: AS VISUALISED AND INTERPRETED BY DARWINISM.[1]

THE lecturer began by stating that, although the theory of Darwinism is one of the most simple of comprehension in the whole range of science, there is none that is so widely and persistently misunderstood. This is the more remarkable, on account of its being founded upon common and universally admitted facts of nature, more or less familiar to all who take any interest in living things; and this misunderstanding is not confined to the ignorant or unscientific, but prevails among the educated classes, and is even found among eminent students and professors of various departments of biology.

Darwinism is almost entirely based upon those external facts of nature, the close observation and description of which constituted the old-fashioned "naturalists," and it is the specialisation in modern science that has led to the misunderstanding referred to. Those who have devoted years to the almost exclusive study of anatomy, physiology, or embryology, and that equally large class who make the lower forms of life (mostly aquatic) the subject of microscopical investigation, are naturally disposed to think that a theory which can dispense with all their work (though often strikingly supported by it) cannot be so important and far-reaching as it is found to be.

Numbers, Variety, and Intermingling of Life-forms.

Coming to the first great group of facts upon which Darwinism rests, the lecturer directed attention to the great number of distinct species, both of vegetable and animal life, found even in our own very limited and rather impoverished islands, as compared with more extensive areas. Great Britain possessed somewhat less than 2000 species of flowering plants, while many equal areas on the Continent of Europe have twice the number. The whole of Europe contains 9000 species, and the world 136,000 species already described; but the total number, if the whole earth were so well known as Europe, would be almost certainly more than double that number, or about a quarter of a million species. The following table, showing how much more crowded are the species in small than in large areas, was exhibited on the wall. It affords an excellent illustration of the fact of the great intermingling of species, so that large numbers are able to live in close contact with other, usually very distinct, species.

Numbers of Flowering Plants.[2]

	Square miles	Species
The County of Surrey	760 ...	840
A portion containing	60 ...	660
,, ,, ...	10 ...	600
,, ,, ...	1 ...	400

The above figures were given by the late Mr. H. C. Watson, one of our most eminent British botanists, and as he lived most of his life in the county, they are probably the results of his personal observation, and are therefore quite trustworthy.

Continuing the above inquiry to still smaller areas, one perch, equalling 1/160 acre, or less than the 1/100,000 of a square mile, has been found to have about forty distinct species, while on a patch 4 feet by 3 feet in Kent (or about 1/25,000,000 of a square mile) Mr. Darwin found twenty species.

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[1] Abstract of discourse delivered at the Royal Institution on Friday January 22, by Dr. Alfred Russel Wallace, O.M., F.R.S.

[2] Other tables illustrating similar facts in other parts of the world were prepared, but not exhibited, as being likely to distract attention from the lecture itself.